Plant community development after eight growing seasons in the two experimental wetland basins

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Introduction

Since 1994, we have been monitoring the plant cover and species richness in the two experimental basins at the Olentangy River Wetland Research Park (ORWRP). In May 1994, Wetland 1 was planted with 2,400 individuals of 13 species of native wetland plants while Wetland 2 was left unplanted as a control (Mitsch et al., 1998). The hypothesis regarding these basins was that "planted and unplanted basin will be similar in function in the beginning, diverge in function during the middle years and ultimately converge in structure and function" (Mitsch et al., 1998).

This paper presents interpretation of aerial photography at the ORWRP taken on August 14, 2001, the end of the eighth growing season for these basins. The first seven years are summarized by Mitsch and Zhang (2001). The objective was to determine the spatial patterns of plant communities within the two wetlands and to determine changes over previous years.

Methods

A color aerial photograph taken by ODOT on August 14, 2001 was used to outline the wetland areas and the dominant vegetation communities for 2001. The photograph was scanned and imported into Arcview 3.2. Different colorscale areas were identified and a number of polygon layers for vegetation communities were constructed. Field checks were undertaken WHEN? to verify the accuracy of the interpretation of the 2001 photograph. With spatial analysis in Arcview 3.2, those polygons were exported to raster (gridscale) files to compute percentage of area for each vegation community.

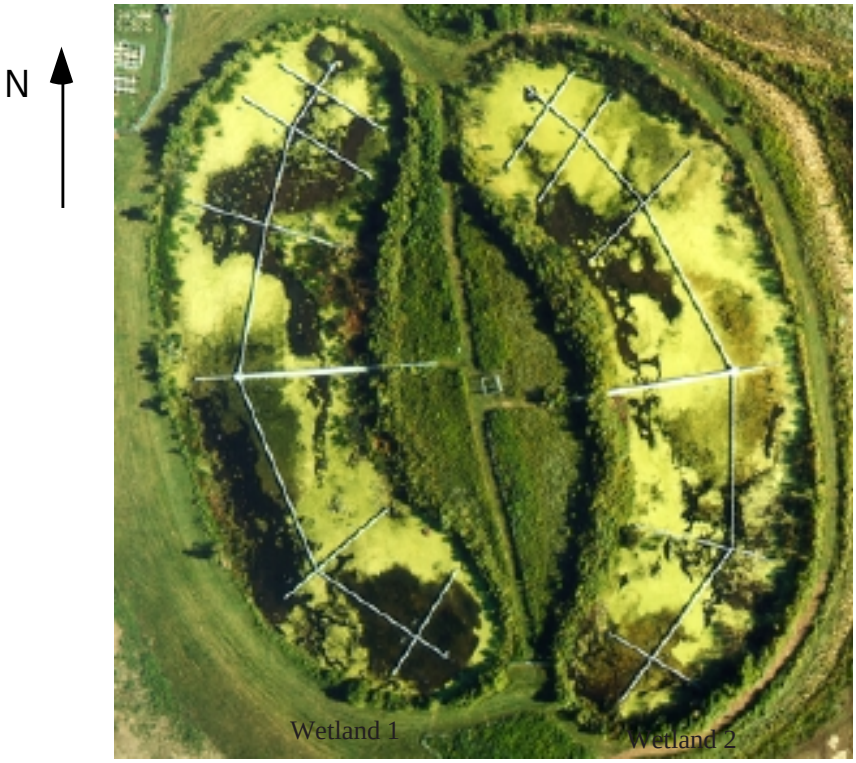

Figure 1. Aerial photograph with blank/white color in August 2001 for the two experimental wetland basins (Wetland 1 and Wetland 2).

Results and Discussion

Wetland 1 had approximately 28% macrophyte cover and Wetland 2 had an estimated 17% macrophyte cover in 2001 (Tables 1 and 2; Figures 1 and 2). These numbers indicate considerably loss in macrophyte cover in both wetlands due to muskrat grazing and other macrophyte loss. Wetland 1 was much less than in 2000 when there was 46% cover and especially in 1999 when there was 60% macrophyte cover. Wetland 2 macrophyte cover was 49% of the basin in 2000 (Mitsch and Zhang, 2001) and 77% of the basin in 1999 (Mitsch et al., 2000). Since 1994, when there was no vegetation cover, coverage had increased yearly in both basins through 199. Wetland 1 had a greater percent coverage than Wetland 2 until 1997, when that trend reversed. Coverage has decreaded in both Wetland 1 and Wetland 2, since 1999 as a result of muskrat activity and possibly increased water levels due to outflow swale sedimentation.

Figure 3 presents dominant vegation community patterns from 1994 - 2001. Table 2 shows coverge (m^2) in each basin by each dominant vegetation communities for the 8 years 1994 to 2001. Figure 4 shows that coverage of major vegetation communities in have changed since 1994. Figure 5 shows that trend of coverage changes of major vegetation communities since 1994. Figure 2 and Table 1 data illustrate another aspect in which the two wetland basins were different in 2001. Four vegetation communities, distinguished by the dominant species, were identified in Wetland 1 while only one was identified in Wetland 2 in 2001.

1) *Typha* dominance increased dramatically in Wetland 2 after 1996. while it generally has remained less than 17% of the vegetation in Wetland 1. At the end of the 2001 growing season, *Typha* was 17% of the total area of Wetland 2 while only 4% of the total area of the originally planted Wetland 1. It was considerably reduced from peak year 1999 when it was 56% of the cover in Wetland 2.

2) Schoenoplectus tabernaemontani (a.k.a. *Scirpus validus*) dominanace increased in both basins from 1995 to 1997 and was 47% and 48% of the total area for Wetland 1 and Wetland 2, respectively in 1997. After 1997, the coverage of *Schoenoplectus tab.* for both basins decreased. At the end of growing season of 2001, *Schoenoplectus* was only 0.3% of total area of Wetland 1 and was generally absent from Wetland 2.

3) *Spartina pectinata* accounted for 1.8% of the cover in Wetland 1 and was found in the shallow water on the west mudflat. It does not appear in Wetland 2. It did not appear in database as a distinct community until 1999; this plant has persisted in small patches since the planting on the edge of the wetland and is now forming patches large enough to be seen by aerial photography. *Spartina* increase was likely due to the dry growing season in 1999.

4) *Sparganium eurycarpum* has been a major community in Wetland 1 since 1997. It was 22% of the total area of Wetland 1 in 2001, 16% of the total area in 2000 and 29% of the cover in 1999. *Sparganium eurycarpum* has never occurred in Wetland 2.

Table 1. Coverage (%) in each of the experimental wetlands by each dominant vegetation species in 2001.

Communitiy	W1	W2
Emergent Vegetation Community		
Schoenoplectus tab.	0.3	0
Sparganium eurycarpum	21.7	0
Spartina pectinata	1.8	0
Typha sp	3.7	17.3
Total Vegetation	27.6	17.3
Open Water	72.4	82.7
Total	**100**	**100**

One of the most significant changes was the decreased coverage by *Schoenoplectus tabernaemontani* in 2001 in both wetlands. In 1998, this species dominated 68% of Wetland 1 vegetation cover and 38% of Wetland 2 vegetation cover. In 1999, the species were 23% and 8%, respectively for Wetlands 1 and 2. In 2000, it was 9% and 3% respectively. In 2001, the species only were 0.3% and 0%, respectively.

The decrease in vegetation cover from an average of 66.5% in 1999 to 47.5% in 2000 to 22.5% was due to principally to coninued muskrat herbivory and use for lodges. The number of muskrat lodges over winter is a strong indicator of macrophyte grazing and use (Higgins, 2002). In the winter of 1999-2000, there were 44 muskrat lodges in the two experimental wetland basins and average macrophyte coverage loss was 19%. In the winter of 2000-01, there were 37 muskrat lodges and coverage loss was 15%. By the winter of 2001-02, a few months after this 2001 vegetation pattern, the number of muskrat lodges decreased to 18.

Another factor that may have led to plant community loss is slight increases in water level. There was considerable sedimentation in the past 8 years in the outflow swale that may have led to a backwater effect in the experimental basins that have not had outflow weirs for a number of years. This suggestion needs more study. The swale was channelized in spring 2002 to minimize this effect in future years.

References

Higgins, C. 2002. Ecosystem engineering by musrats (*Ondatra zibethicus)* in created freshwater marshes. Masters thesis, Environmental Science Graduate Program, The Ohio State University, Columbus.

Mitsch, W.J., V. Bouchard, E.C. Hofherr and N. Wang. 2000. Plant community developmnet after six growing seasons in the two experimental wetland basins. In: W.J. Mitsch and L. Zhang (eds.), Olentangy River Wetland Research Park at the Ohio State University: Annual

Table 2. Coverge (m^2) in each basin by each dominant vegetation communities between 1994 -2001.

Zone (m^2) that are dominated by	1994		1995		1996		1997		1998		1999		2000		2001	
	W1	W2	W1	W2	W1	W2	W1	W2	W1	W2	W1	W2	W1	W2	W1	W2
Total basin	8903	8672	8903	8672	8903	8672	8903	8672	8903	8672	8903	8672	8903	8672	8903	8672
Open water	1451	2567	7746	8672	5333	5498	3579	3035	3490	2567	3276	2914	4835	4462	6450	7170
Algal mat	7452	6105														
Schoenoplectus tabernaemontani			1157		3205	3018	4149	4163	3668	2333	1914	876	777	295	26	
Typha spp.					365	165	445	1440	98	3772	792	4882	1479	3916	333	1502
Scirpus fluviatilis							205		392		258		13			
Nelumbo lutea							107	35	89							
Sparganium eurycarpum							418		1166		2261		1407		1930	
Sagittaria latifolia							9									
Spartina pectinata											401		375		164	
Phalaris arundinacea													18			

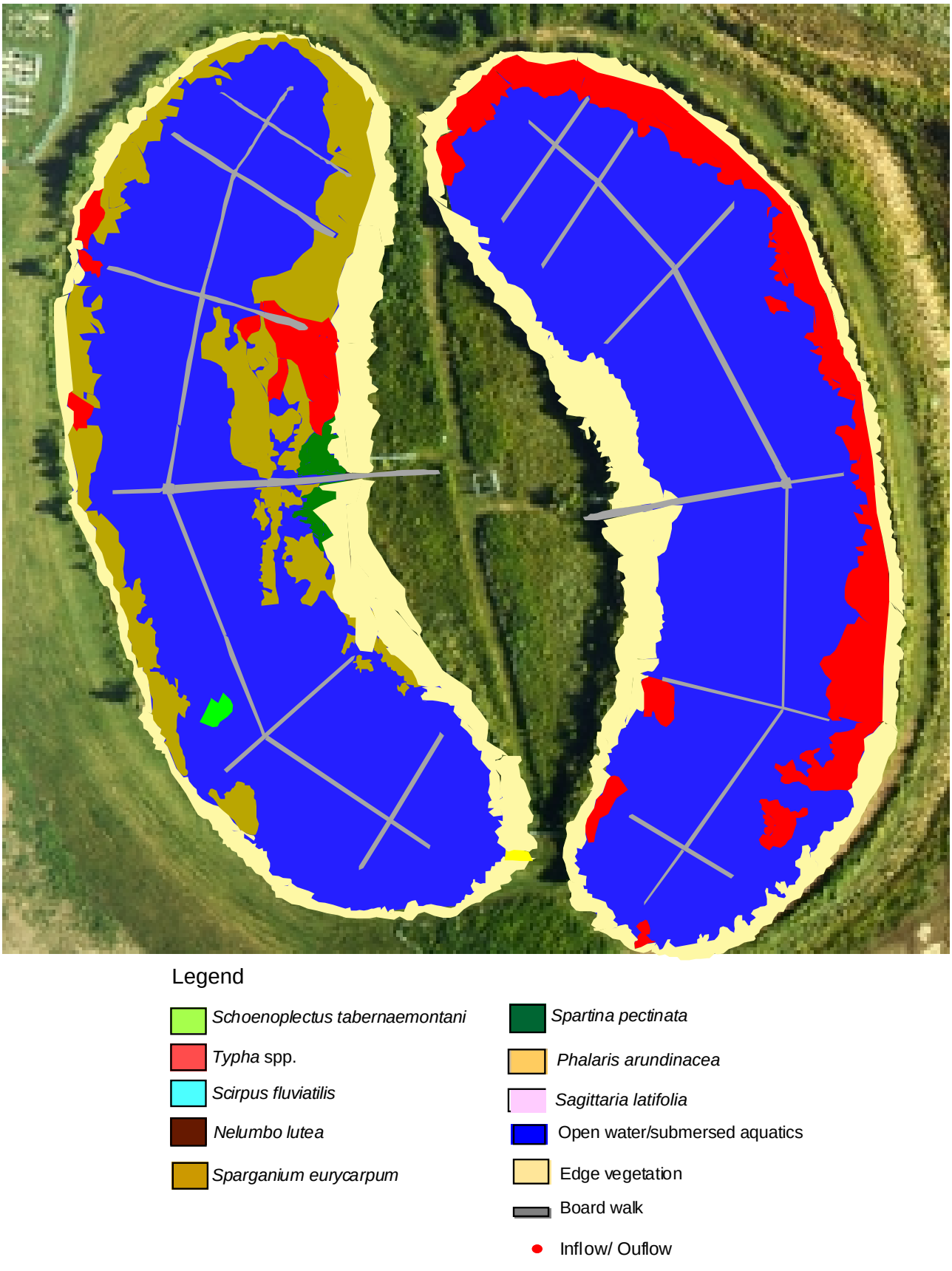

Figure 2. Map of each experimental wetland from October 2001 aerial photograph indicating the areas of dominant species vegetation and open water.

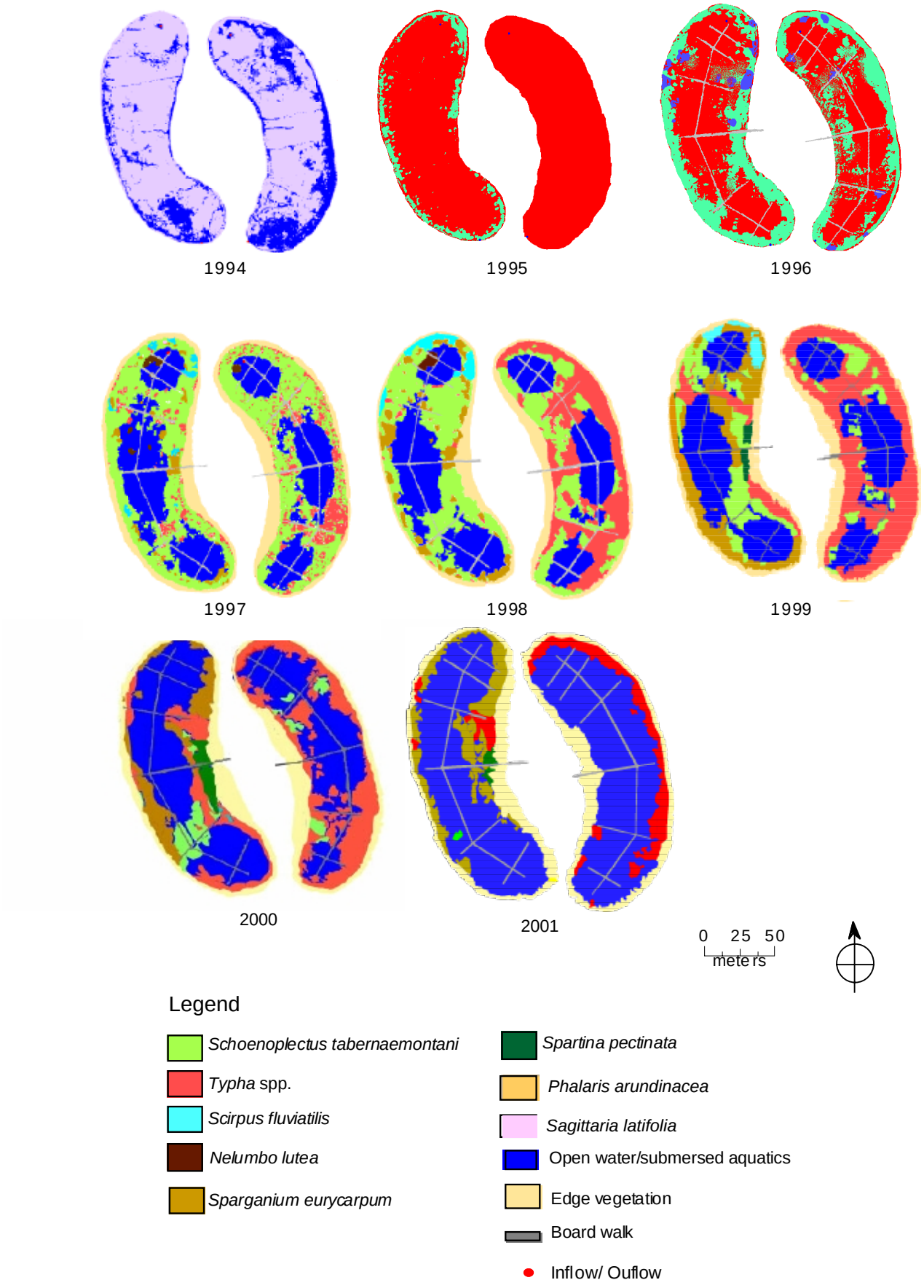

Figure 3. Dominant vegation communities pattern from 1994-2001 in two experimental wetlands.

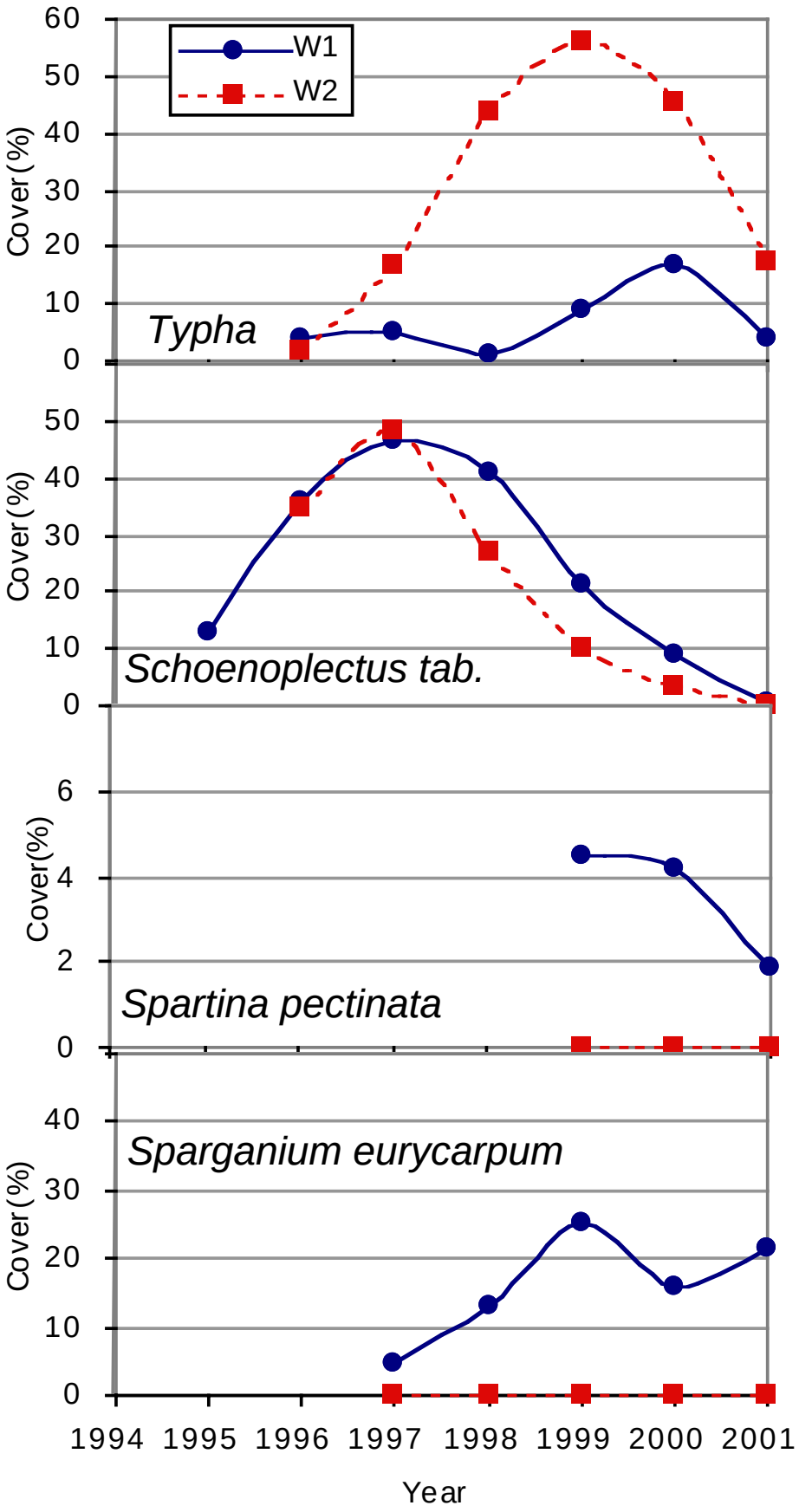

Figure 4. Percent cover of major plant communities over time in two experimental wetlands in 2001.

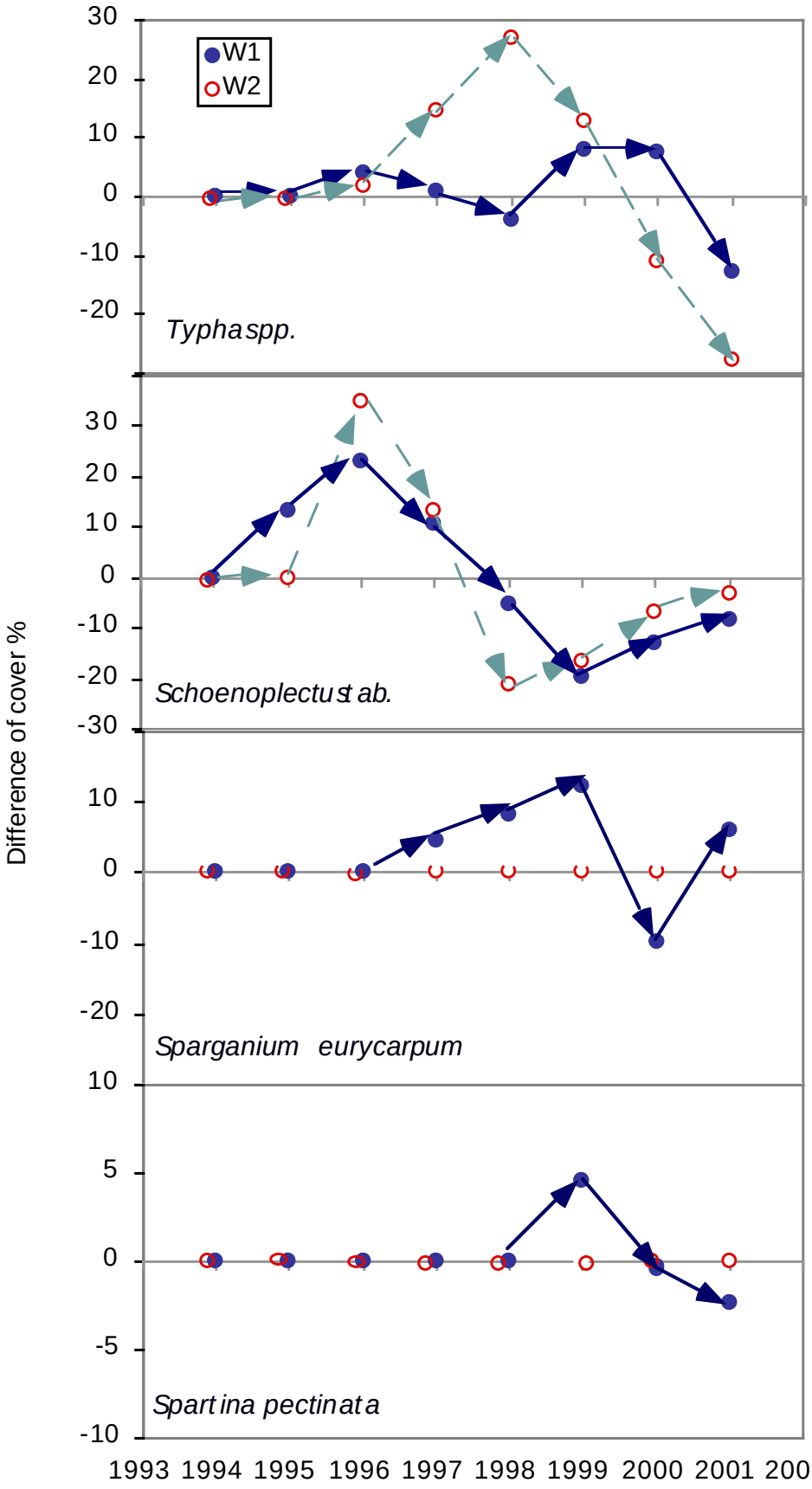

Figure 5. Trend of changes of major vegetation coverage in 2001 from previous year since 1993 for two experimental wetlands

Report 1999. School of Natural Resources, Columbus, OH, USA, pp. 47-58.

Mitsch, W.J., X. Wu, R.W. Nairn, P.E. Weihe, N. Wang, R. Deal and C.E. Boucher. 1998. Creating and restoring wetlands – an ecosystem experiment in self-design. BioScience 48: 1019-1030.

Mitsch, W.J., L. Zhang. 2001. Plant community developmnet after seven growing seasons in the two experimental wetland basins. In: W.J. Mitsch and L. Zhang (eds.), Olentangy River Wetland Research Park at the Ohio State University: Annual Report 2000. School of Natural Resources, Columbus, OH, USA, pp. 43-48.